

Frogs eat butterflies: temporary prey-specialization on the Painted Lady butterfly, *Vanessa cardui*, by Sahara frog, *Pelophylax saharicus*, in the Moroccan Anti Atlas

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Abstract. Observations of predation of adult butterflies in the wild are normally very difficult to obtain. Although there is the popular belief that frogs are amongst the natural enemies of butterflies, empirical evidence for such a relationship is almost lacking. In this note we report various observations showing that this predator-prey interaction seems to occur on a regular basis between the Sahara frog, *Pelophylax saharicus*, and the Painted Lady, *Vanessa cardui*. Following seasonal increases in the local abundance of the Painted Lady in the Moroccan Anti Atlas, *P. saharicus* shows temporary prey-specialization on this migrant butterfly.

“*Frogs Eat Butterflies. Snakes Eat Frogs. Hogs Eat Snakes. Men Eat Hogs*”

Wallace Stevens (1879–1955)

Introduction

The title of a poem from Wallace Stevens’s first book of poetry, *Harmonium* (1922), brings to our minds a frog extending its fleshy tongue or leaping with its mouth open in an attempt to catch a butterfly. Although this is a rather usual image in illustrated children’s books showing animal interactions (see, for example, *About Flies and Elephants*, Lemniscat, Rotterdam, 1994, where a Marsh frog is trying to catch a Red Admiral), one may ask if there is indeed any empirical evidence that frogs eat butterflies. So far, we have only found an old report of American Bullfrogs, *Rana catesbeiana* (Shaw), catching and eating a dozen large yellow and black swallowtails (probably *Papilio glaucus* L.) mud-puddling on a pool’s banks in North Hampshire (Mavourneen 1916). The author vividly described how four big Bullfrogs came out of the water and approached the butterflies “in the stealthy manner of a cat stalking a mouse”, crawling on all four legs, sometimes advancing rapidly and sometimes stopping short until the butterflies were within a foot. Then the frog would jump upon the butterfly, catch it in its mouth, and immediately swallow it whole. This process was repeated until all but one butterfly had been captured, with one frog having eaten at least five butterflies.

During two expeditions to Morocco in 2003 and 2009, we were able to record this kind of interaction again, this time between Sahara frogs *Pelophylax saharicus* (Boulenger in Hartert, 1913) and *Vanessa cardui* (L., 1758). Far from being an exceptional phenomenon, it seems to represent a particular, but regular, case of temporary prey-specialization following seasonal increases in the local abundance of this migrant butterfly.



Fig. 1. The creek near Ouarzazate where most of the observations of Sahara frogs, *Pelophylax saharicus*, catching Painted Ladies, *Vanessa cardui*, were made.

Fig. 2. A frog in ambush, before trying to catch a Painted Lady nectaring on *Dittrichia viscosa*.

Fig. 3. A frog returning to the water after having caught a Painted Lady. (photo credits: 1–2. C. Stefanescu; 3. T. Webb).

Field observations

The expeditions were mainly focused around the Jbel Sarhro (the region in the Anti Atlas lying between Ouarzazate, Agdz and Boumaine-du-Dades) in the second fortnight of October, that is, in a period when *V. cardui* engages in southward migration from the European continent and arrives in North Africa for autumn breeding (pers. obs.). Population levels of *V. cardui* across Europe had been very high in spring and summer in both 2003 and, especially, in 2009 (e.g. Stefanescu et al. 2007, submitted; Fox in press), for which reason the butterfly was incredibly common in central Morocco by the time the expeditions took place.

The first records were obtained in a visit to Tizgui waterfalls, not far from Agdz (N 30° 46' 34.38", W 6° 31' 44.41"), on 19 October 2003. Painted Ladies were congregating in great numbers on the brook banks, for mud-puddling (a common behaviour in Morocco, under hot and dry weather). For a period of about two hours around noon, we observed numerous frogs from the dense population occurring in the area trying to capture the butterflies. The typical behavioural sequence comprised the detection of a Painted Lady shortly after landing while the frog was still in the water, a change in the frog's body direction orientating directly towards the butterfly, a rapid approach through the water and, once out, the characteristic stalking approach until the butterfly was within



Figs 4–5. Two sequences of a Sahara frog engulfing a Painted Lady, after a successful attack. (photo credits: 4–5. G. Hatherley).

leaping reach, exactly as described by Mavourneen (1916). However, contrary to that earlier report, not a single attack ended successfully: all Painted Ladies escaped in the very last moment, thus avoiding the hopping frogs. On several occasions, we even saw how a single butterfly was simultaneously detected by two or three frogs, which truly competed for the potential prey causing it to flee.

The second set of observations was made around noon on 24 October 2009, along a creek by the road going from Ouarzazate to Agdz (N 30° 49' 59.70", W 6° 47' 1.90"). While taking pictures of a vast concentration of Painted Ladies nectaring on various bushes of *Dittrichia viscosa* (L.) W. Greuter growing on the shores of the stream (Fig. 1), we realized that dozens of frogs were hidden among rocks under most of the plants, waiting in ambush for the butterflies (Fig. 2). We soon spotted the first of ca. 10 successful attacks, which invariably followed the same sequence: when a Painted Lady landed on a near flower, the frog would creep slowly closer, rotate the body towards the butterfly, stretch the front legs to raise the body and, once within striking distance, eventually lunge towards the prey with its mouth open. In approximately one out of three trials, the attack ended successfully, with the frog immediately engulfing the butterfly; in a few cases, it took a while before the butterfly was completely swallowed up, its wing tips protruding from the frog's mouth for a few seconds (Figs 3–5). As previously recorded, it was not rare to see several frogs competing for the same butterfly, especially under some isolated plants where up to four or five frogs congregated.

The third and last observations were obtained on the river banks near Tassetifte, south of Tazenakht (N 30° 22' 37.40", W 6° 52' 8.30"), on 26 October 2009. Once again, around noon, we saw numerous Painted Ladies coming to the shores for mud-puddling, and the local population of frogs trying to capture them in the way described by Mavourneen (1916). On that occasion, we only recorded a single successful attack among a dozen failures.

Discussion

Our observations showed a remarkable coincidence in timing and spatial location. This leads us to suggest that the predator-prey interaction between Sahara frogs and Painted Ladies is not a casual one but occurs on a regular basis in those areas of the Anti Atlas that are seasonally colonized by *V. cardui*. Following mass migration (as in 2003 and 2009), the butterfly can reach extremely high population levels and becomes a major feeding resource for the Sahara frog and other opportunistic predators. For instance, it seems beyond doubt that, at least in October 2009, the diet of the frogs in the creek near Ouarzazate mainly consisted of Painted Ladies effectively captured through a well developed ambush behaviour. A similar situation is to be expected in similar habitats, perhaps throughout all the Maghreb region, where *P. saharicus* is the most common amphibian species (IUCN 2009). On the other hand, the hunting strategy did not work so well on bare ground along river banks, where Painted Ladies are used to congregating for mud-puddling. Without the camouflage provided by the vegetation, the frogs were normally detected by the butterflies, allowing the butterflies to escape from the attacks. However, it is possible that this same behaviour is still effective for other slower butterfly species, as for example the Swallowtails reported by Mavourneen (1916).

Interestingly, opportunistic feeding specialization on migrant butterflies had been recorded previously, but always involving some bird species taking advantage of massive concentrations or predictable movements of migrants. Larsen (1992) described such a situation for a group of Bluecheeked Bee-eaters, *Merops persicus* (Pallas), specializing in *Catopsilia florella* (F.) in Botswana. As for the Painted Lady, Larsen (1989) and Stefanescu & Julià (2002) reported various observations of insectivorous birds (e.g. Spotted Flycatcher *Muscicapa striata* (Pallas) and European Bee-eater *Merops apiaster* (L.)) preying upon spring migrants. A further example of opportunistic behaviour by insectivorous birds was recorded in Morocco in October 2009, when different bird species were often seen patrolling along road banks in search of Painted Ladies recently killed by the cars (C. Stefanescu & F. Páramo, in prep.).

Our field observations indicate that opportunistic feeding specialization on an abundant butterfly species also occurs in the Sahara frog and, perhaps, in other frogs showing similar feeding behaviour. In this respect, the closely related Perez's frog, *Pelophylax perezi* (Seoane), and Marsh frog, *Pelophylax ridibundus* (Pallas), are highly generalist predators that include unidentified Lepidoptera in their diet, specialize in temporary abundant prey, and use a sit-and-wait strategy similar to that described in this paper (e.g. García París et al. 2004; Balint Szeibel et al. 2008). In conclusion, although difficult to observe, there are good reasons to believe that, indeed, frogs eat butterflies.

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